Silvicultural Systems
IN BRITISH COLUMBIA

AN OVERVIEW

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British Columbia is an ecologically diverse province, containing more than 600 identified ecosystems. Few forestry regions in the world have as much variation and complexity in their forests.

This publication is designed to explain the basic silvicultural systems currently being used in British Columbia.

A well-designed silvicultural system represents a balance between the art and science of forestry. It reflects an understanding of ecological relationships, the long-term objectives of the landowner, the physical characteristics of the forest land base, and a spirit of innovation and creativity.

All decisions about which silvicultural system to use must be made on an individual site-specific basis. One option does not fit all! Often there is more than one choice that is suitable for a site. In these cases, a 'custom-built' approach, based on stand-structure objectives, will act as a guide for the final decision.

Each silvicultural system produces a different stand structure, and can be adjusted to meet a single objective or a range of objectives. However, since site conditions, climate, tree species, and social and economic conditions vary widely across the province, no one silvicultural system can meet all management objectives.

What is a Silvicultural System?

A silvicultural system is a planned program of activities by which a forest stand or a group of trees is harvested, regenerated and tended over an extended period to achieve a predictable yield of benefits.

Seven general types of silvicultural systems are used in British Columbia. Their names reflect the type of forest stand structure that will remain after harvesting or other activity. They are normally referred to as:

- clearcutting
- coppice
- patch cut
- retention
- seed tree
- selection
- shelterwood.

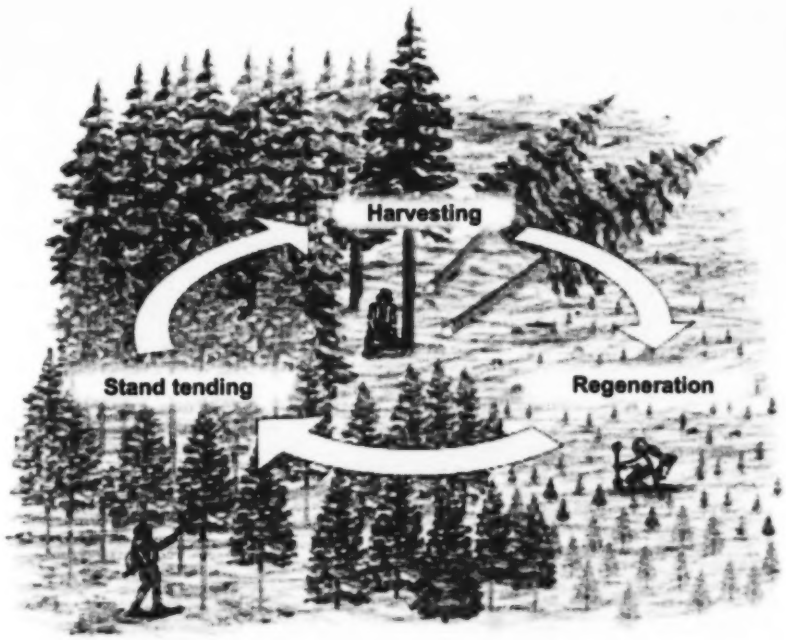
Each of these systems can be modified to accommodate local site conditions and management objectives.

There are two basic classes of silvicultural system: even-aged and uneven-aged.

Even-aged systems generally create stands where the trees are of approximately the same age, or of one age class. However, in some cases, even-aged systems can result in trees of two distinct age classes of trees when some older trees are left after harvesting. Clearcutting, coppice, patch cutting, retention, seed tree and shelterwood are generally considered to be even-aged systems.

In uneven-aged systems, which employ variations of the selection system, stands are maintained or created with trees in three or more age classes. Selection systems create gaps or openings for the regeneration of new trees.

An intermediate cut, where some of the trees are harvested prior to the main cut, is not a silvicultural system, but may occur one or more times in the various systems depending on the management objectives for the area. Variations of intermediate cuts include commercial thinning and pole harvesting.



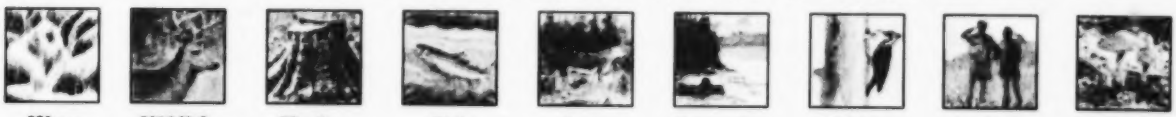
Typical sequence of activities for a silvicultural system.

Choosing a Silvicultural System

Several systems may match the management objectives for a stand. Each system has attributes that will dictate the resultant stand structure and, consequently, determine the appropriateness of the system. Some important factors to consider when selecting a silvicultural system are:

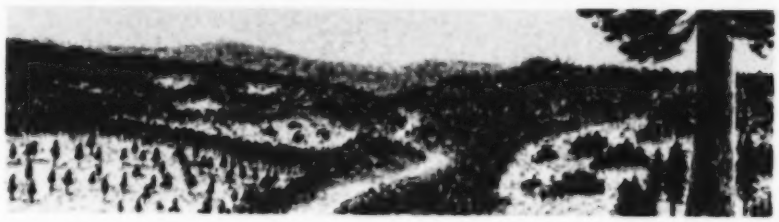
- Forest stand and site characteristics, such as:
  - climate
  - forest health
  - existing forest stand structure
  - soils
  - terrain
  - windthrow
  - vegetation
  - hydrology.
- Forest resource values, such as:
  - aesthetics
  - biological diversity
  - fish and wildlife
  - timber
  - botanical forest products (e.g., mushrooms or floral vegetation)
  - range
  - recreation
  - water quality/quantity
  - visual quality.
- Economic costs and benefits associated with different silvicultural systems.
- Resource management objectives, such as:
  - habitat protection
  - maintenance of long-term site productivity
  - maintenance of water quality/quantity
  - maintenance of visual quality objectives
  - worker safety.

Resource Management Objectives and Values to Consider



Water **Wildlife** **Timber** **Fish** **Range** **Recreation** **Habitat** **Aesthetics** **Other**

Forest structure required to meet management objectives



Choice of the appropriate silvicultural system

Silvicultural Systems Used in British Columbia

Seven silvicultural systems are used in British Columbia.

The Clearcut System

This system is generally similar to clearcutting—the majority or all of the existing trees are removed in one harvest. The major difference is that regeneration comes primarily through the sprouting of stumps and the suckering of old root systems. This system is limited to deciduous species management.

Uncut stand

Ten years after harvest

The Retention System

The retention silvicultural system involves retaining individual trees or groups of trees for at least one rotation, to maintain structural diversity over the area of the cutblock. As well, the retention system will leave more than half the total area of the cutblock within one tree length from the base of a tree or group of trees, whether or not the tree or group of trees is inside the cutblock (forest influence).

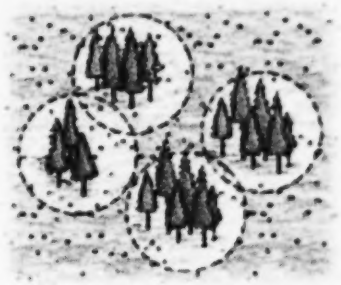
Retention can be dispersed throughout a cutblock as single trees or aggregated as groups of trees. The proportion of an opening influenced by the surrounding trees differentiates a clearcut from a retention system.

In the retention silvicultural system, the focus is placed on what will be retained rather than on what will be harvested. Retention areas are designed to provide late successional stand structures to enrich biodiversity, enhance habitat connectivity over the landscape, and to supply refuges for species survival and dispersal after harvesting.

Some factors that may affect the use of the retention silvicultural system are:

- retains structural features of the original stand that may be important (e.g., snags, large woody debris, live trees of varying sizes, and canopy layers) as potential habitat for a variety of organisms
- can mitigate factors such as visual viewscapes and wildlife habitat
- can facilitate the establishment of shade-tolerant species or species that require a shaded environment to establish
- competing brush species present on site may make regeneration difficult
- harvesting and site preparation costs can be higher
- retained trees may be exposed to windthrow.

Retention objectives are unique to the individual area or landscape unit. These objectives must be clearly expressed in the operational plan for the area.



Not drawn to scale.

Area under forest influence. One tree height equals area of forest influence.

Retention structures can be dispersed, grouped, or a combination of the two.

The Clearcutting System

Trees within an area larger than one hectare and greater than two tree lengths in width are removed in a single harvest.

Some factors that may affect the use of the clearcutting silvicultural system are:

- the type of existing tree species on the site (e.g., pioneer species, such as lodgepole pine and western larch, prefer direct sunlight for regeneration)
- the age and condition of the stand may make retention of many of the existing trees unfavourable to worker safety or to the new crop (e.g., existing forest health concerns such as dwarf mistletoe in western hemlock)
- the visual impact on the landscape is usually significant
- the cover requirements for the identified wildlife species in the area.

Clearcutting, patch cutting and coppice systems end the growth cycle of a mature forest stand and begins the regeneration of a new, managed even-aged stand.

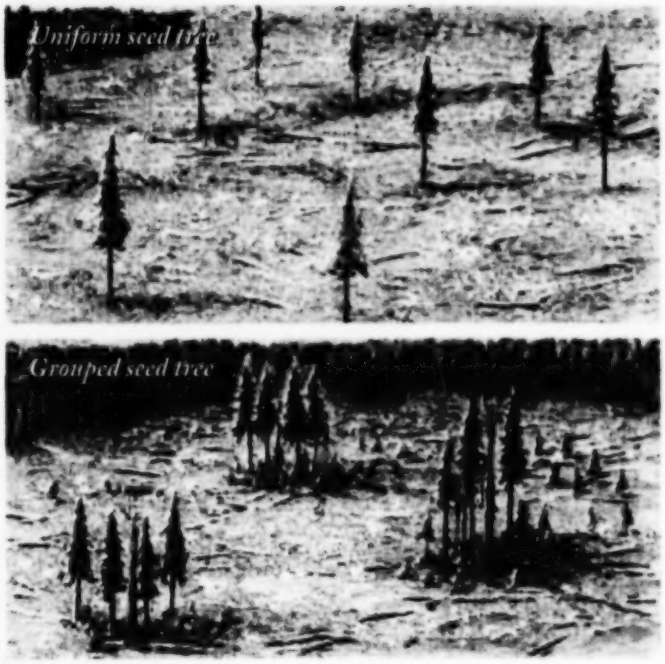
The seed tree system

The seed tree silvicultural system leaves selected trees standing in a cutblock, either uniformly or in small groups, to provide a natural seed source for regeneration. The management objective is usually for the largest, most desirable trees to be left. These tend to be the most wind resistant and will produce high-quality trees for the next rotation.

The number and distribution of seed trees depends on many factors, such as the preferred species and density of seedlings, how frequently the seed trees produce cones, and the distance seed travels from parent trees. Seed trees may be harvested once regeneration has been established. If they are retained for an entire rotation, where other management objectives such as wildlife, biological diversity and visual quality are important, or where removal would damage the new forest, they are called reserve trees.

Some factors that may affect the use of the seed tree silvicultural system are:

- species composition of new stands can be better controlled than with other systems using natural regeneration
- leave tree patterns can be designed to accommodate certain wildlife requirements such as nesting sites and perch trees for large bird species
- windthrow in some species and site conditions can be a problem
- volume recoveries from the sites will be lower because of the number of retained trees.



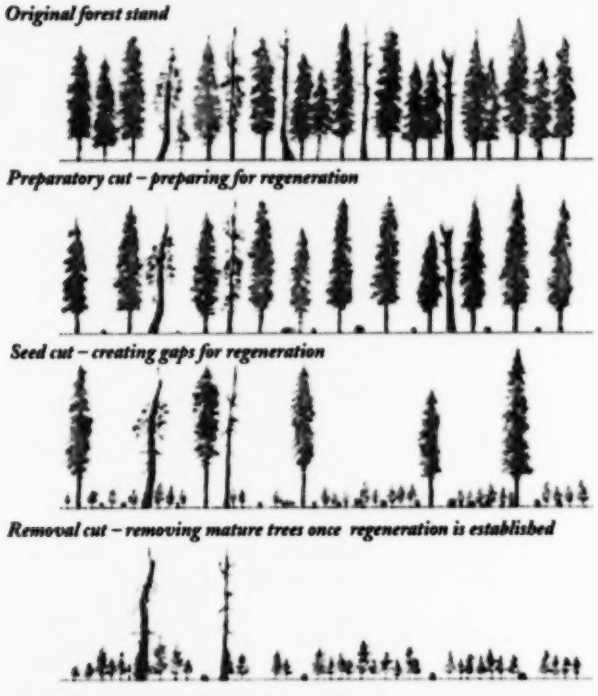
With the seed tree system, the largest, most desirable trees are generally left behind to help regenerate a new stand.

The shelterwood system

Mature trees are removed in the shelterwood system in a series of cuts designed to establish a new even-aged stand under the shelter of the remaining trees. These remaining mature trees provide protection and shelter to young trees, which may be established either naturally or through planting.

Some factors that may affect the use of the shelterwood silvicultural system are:

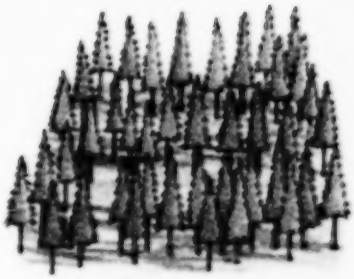
- regeneration that may be sensitive to establishment problems, such as frost, drought and cold winds, may be protected by remaining trees
- less visually disruptive to landscape
- wildlife and other management objectives requiring the retention of overhead cover may be addressed
- more costs are involved for layout, planning, and harvesting
- regeneration may be subject to damage from initial and subsequent harvesting
- some forest health problems, such as root diseases, can be exacerbated by leaving cut stumps adjacent to retained trees.


Original forest stand
Preparatory cut – preparing for regeneration
Seed cut – creating gaps for regeneration
Removal cut – removing mature trees once regeneration is established

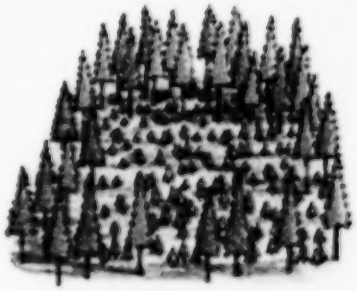
With the shelterwood system, the arrangement of mature trees left after each successive cut depends on management objectives and local site conditions.

The Patch Cut System

The patch cut silvicultural system involves removing an entire stand of trees less than one hectare in size in one harvest. Each patch cut is managed as a distinct even-aged opening. If an area contains several patch cuts, each opening is managed as a distinct even-aged opening. Regeneration is achieved through planting or natural regrowth, or a combination of the two.



A patch of the stand is generally cleared, removing the forest overstorey in one harvest at the end of the rotation.



The regeneration period is short and occurs soon after the harvest.

The Selection System

The selection silvicultural system maintains a continuous uneven-aged forest stand cover by harvesting a limited number of trees of various sizes and ages over time. Mature and immature trees are harvested either individually (single tree selection) or in groups (group selection). Harvests take place at regular intervals, usually one-third or less of the planned maximum age of the oldest age class of the trees that are to be managed for a timber objective.

The selection system promotes continuous regeneration by creating gaps in the forest by removing selected trees. To ensure these gaps are regenerated with healthy and vigorously growing trees, the new trees must be tended and thinned if necessary.

Some of the factors that could affect the use of the selection silvicultural system are:

- well suited to species that require an uneven-aged type of management for stand development or regeneration
- on smaller landbases, landowners can harvest smaller quantities over more frequent intervals to ensure economic sustainability
- regeneration that may be sensitive to establishment problems (e.g., frost, drought and cold winds) may be protected by remaining trees
- less visually disruptive to the landscape
- wildlife and other management objectives requiring retention of overhead cover may be addressed
- more costs are involved for layout, planning and harvesting
- regeneration may be subject to damage from initial and subsequent harvests
- some forest health problems, such as root diseases, can be exacerbated by leaving cut stumps adjacent to retained trees.

With the selection system, trees may be harvested individually or in small groups up to several tree lengths in width.

The Future

In British Columbia there is an ongoing commitment to change. Differing management objectives will always present challenges for managers. Silvicultural systems will continue to be modified and evolve to meet British Columbia's needs and a changing world.

For More Information

For more information on silvicultural systems, contact your nearest Forest Service office or:

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